USING THE INTERNATIONAL CLASSIFICATION FOR DETAILED OBSERVATIONS.

Is there not a way of using the International Classification so as to show details of cloud appearance to any extent needed? H. H. Clayton's detailed system has not been widely used because of its unwieldy Latin names.[23]

The most important of his subclasses; and a few new ones, however, can be given descriptive English adjectives or otherwise briefly described, and these can be designated in cloud records by exponential letters which are in many cases identical with those used by Clayton: *f* (ragged), *t* (thin), *n* (rain or snow falling from cloud, whether or not precipitation reaches the ground), *c* (part of, or derived from, thunderstorm cloud), *r* (roll cloud), *s* (smooth), *q* (very fine texture), *c* (tall relative to width), *l* (lenticuloid, i. e., with part or all bounding lines like the smooth curves of a lens),[24] *m* (mammillated), *u* (undulated), *b* (in bands or streaks), *z* (in zig-zags, or with marked angles in lines—fibrous clouds only), *d* (detached units—not needed with Ci. and Cu.).

Thus, St^{f} represents fracto-stratus; A.Cu.^{t} disk-like, or ice-cake form, alto-cumulus; A.St.^{sn} smooth alto-stratus from which rain or snow is falling.

The use of one, two, or three of the international names for different parts of the same cloud sheet, adds greatly to the possibility of expressing adequately the appearance of the clouds.

CONCLUSIONS.

1. Cloud-records to be comparable should be based on the appearance of the clouds as seen from the ground. If (as we can not) we could always know the origin of a cloud, a classification on the basis of origin would be preferable. The elements of cloud appearance may be recorded without naming cloud types; but for discussion names are necessary.

2. International agreement has provided a set of 10 cloud names to cover all cloud forms; but the definitions of these 10 do not include all cloud forms, nor do they differentiate them adequately. The chief sources of trouble are as between the following pairs: Ci.Cu. and A.Cu., Ci.St. and A.St., Nb. and other rain clouds, and, perhaps, St.Cu. and St. or A.St. If Ci.Cu. as defined is confined to ice-clouds, the frequent misnaming of A.Cu. will be eliminated. If it is generally understood that A.St. may be either a more or less dense fibrous, mammilated or smooth cloud of snowflakes, or a smooth, undulated, or mammilated water-droplet cloud, which is sometimes as thin and white as Ci.St., our difficulties on its score will be largely removed. If it is recognized that *nimbus* is the name of a cloud form, and not a synonym for the occurrence of precipitation, much further trouble will be prevented. Finally, if St.Cu. is always thought of as strato-*cumulus*, there will be less of the indiscriminate misnaming of irregular St. and A.St. With these and other difficulties removed it is possible to construct a tabular guide which will indicate which one of the 10 names to apply to any cloud that an observer can describe.

3. A vocabulary of 10 words, is, however, rather limited for recording and discussing the manifold aspects of the sky. The inadequacy of the language of some African tribes has contributed in no small degree to holding them at the bottom of the culture scale. On the other hand, the wide range of expression and shades of meaning allowed by the English language has been a decidedly favorable factor in the rise of English speaking peoples to their present position in the world. Let us adopt a set of standard characteristics, such as: Mammillated, ragged, undulated, etc. If, in addition, we make separate notation of density and actual, computed, or probable height, our cloud records will give a real indication of the aspect of the sky, and will thus complete the weather-picture provided by instruments, meteorographs, and pilot balloons.

ACKNOWLEDGMENT.

For months Mr. S. P. Fergusson has been giving me the benefit of his years of familiarity with the growth of the International Classification and with the detailed observing of clouds at Blue Hill Observatory. I wish to acknowledge gratefully his many suggestions, especially his service in checking tendencies to deviate too far from well-tried practice.

How to make and reduce detailed cloud observations and the use of a new form for cloud records will be presented in a later paper.

[23] Op. cit., pp. 332-349, ch. 2, "A new detailed nomenclature of clouds, founded on the International nomenclature." Clayton's reasons for proposing these new details were: That they were needed for exact scientific studies, for descriptions of special occurrences, for meteorological observatories where observations are made, and for the use of specialists. His basis was form, altitude, and origin, as compared with Howard's basis of form only, and the International basis of form and altitude (A.Cu. vs. Ci.Cu., A.St. vs. Ci.St.). Although Clayton mentions origin in the cases of Cu. and St., he offers no change in names in consequence. "As the knowledge of the causes of special cloud formations increases, however, increasing weight will no doubt be given to cloud origin in determining classification and nomenclature." With this, the classification becomes one of form and altitude, therefore, much of the chapter is devoted to cloud altitudes. He evolves a detailed system which may serve the specialist who has plenty of time in which to apply it, but the large number of special forms and their Latin names will always cause it to be avoided by all but a very few enthusiasts.

[24] Not usually applicable to Ci., Ci.Cu., A.Cu., St.Cu., Nb., Cu., or Cu.Nb. The use of the word *lenticular* with Ci.Cu. and A.Cu. is common, in spite of the fact that most lenticular clouds are A.St. (cf. J. Vincent, loc. cit.).

LAYER MEASUREMENTS OF SNOW ON GROUND NEAR SUMMIT, CALIF.

By H. F. ALPS and O. H. HAMMONDS.

[Weather Bureau, Reno, Nev., Oct. 9, 1920.]

The layer measurements were made in the open park, about one-fourth mile in a southeasterly direction from the railroad station at Summit, in the same place and in the same manner as during the preceding season. From our experience in this work during the past four seasons, it is believed that this park affords an ideal location for layer measurements of the snow cover.

Only four trips to the Summit were made, on account of the long interval between the first and second general storms in the mountains. The first measurement of the snow cover was made on December 31, 1919. At that time, the depth of the snow was 39 inches, and the ground was frozen to a depth of one inch. The top layer of the snow was slightly granular, due to surface melting. As the snowfall was light in January and the first half of February, the second trip was made on March 5, 1920, when the depth of snow on the ground was 68 inches. The old snow, the greater part of which fell in December, was 35 inches in depth with a 10-inch crust which would support any ordinary vehicle. This

accounts for the great difference in density between the third and fourth layers, as shown in the chart which accompanies this report. The ground was well moistened and not frozen. No drifting effects of the snow were noticed. The third set of measurements was made on April 13, when a total depth of 66 inches of snow was found. The depth of the old snow as clearly shown by the crust was 29 inches. The thickness of the crust varied from 8 to 12 inches, and contained scattered layers of practically solid ice two inches in thickness. The ground was moist and soft but not wet. The last trip of the season was on May 13, when the depth of the snow was 36 inches. The depth of the old snow was 11 inches, the crust of which was hard and icy. There were three icy layers in the old snow, each being from one to two inches in thickness. At places, these crusts nearly united. A coating of about one-quarter inch of ice covered the ground under the snow, and the ground was wet but not frozen. The snow was very granular.

TABLE 1.—*Average densities of foot layer measurements of snow based on records for four seasons.*

Month.	December.	January.	February.	March.	April.	May.
Ground foot	34	38	43	45	49	55
Second foot	31	34	38	42	48	52
Third foot	32	34	35	48	49	55
Fourth foot	27	30	32	40	47	.....
Fifth foot	13	32	31	38	51	.....
Sixth foot	.....	28	28	37	48	.....
Seventh foot	.....	18	25	35	51	.....
Eighth foot	.....	.....	31	33	55	.....
Ninth foot	.....	.....	29	32	50	.....
Tenth foot	.....	.....	28	30	.....	.....
Eleventh foot	.....	.....	25	26	.....	.....
Twelfth foot	.....	.....	31	19	.....	.....
Thirteenth foot	.....	.....	13	17	.....	.....
Fourteenth foot	.....	.....	.....	10	.....	.....

NOTE.—Measurements taken at Summit, Calif., elevation 7,019 feet, for the four seasons, 1916–17, 1917–18, 1918–19, and 1919–20.

The snowfall during the past three seasons was below normal; therefore, measurements of the snow cover during a few seasons of heavy snowfall are much desired.

LIFE HISTORY OF TROPICAL STORM IN LOUISIANA, SEPTEMBER 21 AND 22, 1920.

By ISAAC M. CLINE, Meteorologist.

[Weather Bureau, New Orleans, La., October 20, 1920.]

SYNOPSIS.

The tropical storm which appeared in the Caribbean Sea September 18, crossed the Gulf of Mexico during the 19th and 20th, and moved northward over Louisiana during the 21st and 22d, presents several features of unusual interest. It followed a course out of the ordinary for storms that move over Yucatan, and advanced with unusual rapidity. The storm was not of great intensity except near the center. We have more complete cloud, wind, and pressure records in the area traversed by this storm than have been available for study in any previous storm and these make its life history important in our search for knowledge of tropical storms. The lowest barometer reading after the storm passed inland was 28.99 inches at Houma, La. The depression began to decrease in intensity immediately afterwards. The observed tides were in conformity with the movement of the storm.[1] Warnings were distributed which were instrumental in saving lives and property. There was one death; and property damage was about $1,450,000.

GENERAL METEOROLOGICAL CONDITIONS.

The special meteorological features preceding and attending this storm are given for New Orleans, La., Mobile, Ala., and Pensacola, Fla., stations to the right of the line over which the center of the storm advanced; and for Galveston, Houston, and Port Arthur, Tex., stations to the left of that line.

The clouds of the cirrus type at New Orleans, La., Mobile, Ala., and Pensacola, Fla., stations to the right of the line along which the center of the storm was advancing were from W. on the morning of the 19th, changing to SW. about noon and continuing from that direction while visible during the 20th and 21st, except that at Pensacola, Fla., at noon and 7 p. m. of the 21st they were again visible through the stratus clouds moving from the SE. As the storm receded and curved to the westward, they were reported as moving with the stratus from SE.

The clouds of the cirrus type appeared at Houston, Tex., to the left of the line along which the center of the storm was advancing on the morning of the 20th, coming from SSE.; they were from S. at noon, and SE. during the 21st and 22d.

The only cirrus clouds observed at Galveston, Tex., consisted of a very few fine wisps visible in the SE. about 8 a. m. at an elevation of about 10° with no apparent motion.

[1] See MONTHLY WEATHER REVIEW, March, 1920, 48: 127-146.

PRESSURE IN THE DIFFERENT PARTS OF THE STORM.

Excellent barometer records have been obtained from a number of places well distributed over the area traversed by the storm. The aneroid barometers have been checked with the Weather Bureau barometer and the largest difference was ±0.07 of an inch. The proper corrections have been applied and it is believed that the observations represent the true conditions.

Complete barometer records covering the territory over which a cyclonic area has traveled are not usually found and they furnish interesting and valuable material for use in the study of a tropical storm moving into extratropical regions where the weather conditions at the time are practically the same as those that prevail in the tropics. The lowest pressure, 28.99, was reported from Houma, La., about 30 miles inland from the nearest coast line at 10:15 p. m. on September 21st; the next lowest was 29.09 at 11:20 p. m. at Morgan City, La., 10 miles to the north and 30 miles to the west of Houma. The next lowest was 29.13 at Bayou Goula, La., at 12:30 a. m. of the 22d, 80 miles from the coast. The topographical and physical features of the country for 50 miles from the coast are such that the hurricane, while traversing this area, retained the characteristics which it had in the open Gulf, and the wind and pressure conditions at Grand Isle, Morgan City, and Houma, represent the full intensity of the storm.

The cyclonic area commenced contracting and filling up on its outer rim soon after moving inland, as is shown by the comparison of the lowest pressure at Grand Isle and New Orleans, points about equidistant from the line over which the center of the storm advanced. At New Orleans, 50 miles farther along the line of advance than Grand Isle, the lowest barometer, 29.53, was 0.20 of an inch higher than at Grand Isle, 29.33. Near its center the storm did not diminish in intensity so rapidly. This is shown by the lowest barometer, 75 miles west and 20 miles farther north than New Orleans, at Bayou Goula, 29.13 inches. Bayou Goula is 50 miles farther along the line over which the center of the storm advanced than Houma, and the barometer near the center of the storm shows a rise of only 0.14 of an inch in this distance.